

## **1. PUBLICATIONS AND PRESENTATIONS FOR NNC05GA27G.**

**(February 1, 2007 STATUS)**

### **PRESENTATIONS, NNC05GA27G [PR]:**

PR 01) Presented at 2005 Annual AIChE Meeting (Cincinnati, OH, Oct 30 – Nov. 4)  
AIChE Paper #22828 : Sashidhar S. Panchamgam, Joel L. Plawsky and Peter C. Wayner, Jr.  
“Spreading Characteristics and Microscale Evaporative Heat Transfer in a Moving Meniscus Containing a Binary Mixture” Extended Abstract submitted 9-02-05.

PR02) Presented at 2005 Annual AIChE Meeting (Cincinnati, OH, Oct 30 – Nov. 4)  
AIChE Paper #23015 : Sashidhar S. Panchamgam, Joel L. Plawsky and Peter C. Wayner, Jr. “Microscale Heat Transfer and Fluid Flow in an Evaporating Moving Extended Meniscus” Extended Abstract submitted 9-02-05.

PR 03) (previously SU 01) Sashidhar S. Panchamgam, Joel L. Plawsky, and Peter C. Wayner, Jr.  
,”Microscale Heat Transfer in an Evaporating Moving Extended Meniscus”, ECI Conference on Microscale Heat Transfer, Sept. 25-30, 2005, Castlevectchio Pascoli (Tuscany) Italy.

PR 04) Sashidhar S. Panchamgam, Joel L. Plawsky, and Peter C. Wayner, Jr., ”Reflectivity Based Analysis of Contact Line Behavior and Microscale Heat Transfer in Ultrathin Films,” Poster at the 2<sup>nd</sup> Annual Tech Valley Engineering Symposium, April 18, 2006, Albany, NY.

PR 05) (previously SU 04) Presented at 9<sup>th</sup> Joint AIAA/ASME Thermophysics and Heat Transfer Conference, San Francisco, CA June 5-8, 2006: Sashidhar S. Panchamgam, Joel L. Plawsky, and Peter C. Wayner, Jr. , “Influence of Marangoni Stresses and Slip on Spreading Characteristics of an Evaporating Binary Mixture Meniscus.”

PR 06) (previously SU 05) Presented at 4<sup>th</sup> International Conference of Nanochannels, Microchannels and Minichannels, June 19-21, 2006, Stokes Research Institute-University of Limerick, Limerick, Ireland: .Sashidhar S. Panchamgam, Joel L. Plawsky, and Peter C. Wayner, Jr. , “Experimental Evaluation of Marangoni Shear in the Contact Line Region of an Evaporating 99 + % Pure Octane Meniscus.”

PR 07) ( previously SU 06) Sashidhar S. Panchamgam, Joel L. Plawsky, and Peter C. Wayner, Jr., ”Reflectivity Based Analysis of Contact Line Behavior and Microscale Heat Transfer in Binary Ultrathin Films,” AIChE 2006 Annual Meeting, November 12-17, 2006, San Francisco, California.

### **PUBLICATIONS, NNC05GA27G [PU]:**

PU 01) (previously SU 02 and originally SU 16 under NAG 3-2383) S. J. Gokhale, J. L. Plawsky, and P. C. Wayner, Jr. , “Spreading, Evaporation, and Contact Line Dynamics of Surfactant Laden Micro-Drops” Langmuir, Vol. 21, pp 8188-8197, No. 18, Sept. 2005.

PU 02 ( previously SU 01) Sashidhar S. Panchamgam, Joel L. Plawsky, and Peter C. Wayner, Jr.  
,”Microscale Heat Transfer in an Evaporating Moving Extended Meniscus”, Experimental Thermal and Fluid Sciences, Vol. 30, pp 745-754 (2006), [Preliminary version in Proceedings of ECI Conference on Microscale Heat Transfer, Sept. 25-30, 2005, Castlevectchio Pascoli (Tuscany) Italy].

PU 03) (previously SU 04) Sashidhar S. Panchamgam, Joel L. Plawsky, and Peter C. Wayner, Jr. , “Influence of Marangoni Stresses and Slip on Spreading Characteristics of an Evaporating Binary Mixture Meniscus” Proceedings of the 9<sup>th</sup> Joint AIAA/ASME Thermophysics and Heat Transfer Conference, San Francisco, CA June 5-8, 2006.

PU 04) (previously SU 05) Sashidhar S. Panchamgam, Joel L. Plawsky, and Peter C. Wayner, Jr. , “Experimental Evaluation of Marangoni Shear in the Contact Line Region of an Evaporating 99 + % Pure Octane Meniscus” Manuscript submitted to 4<sup>th</sup> International Conference of Nanochannels, Microchannels and Minichannels, June 19-21, 2006, Stokes Research Institute-University of Limerick, Limerick, Ireland.

PU 05) (previously SU 03) Sashidhar S. Panchamgam, Joel L. Plawsky, and Peter C. Wayner, Jr., “Spreading Characteristics and Microscale Evaporative Heat Transfer in an Ultra-Thin Film Containing a Binary Mixture,” ASME Journal of Heat Transfer, 2006, **128**, pp. 1266- 1275.

**THESES [T], RELATED STUDENT PROPOSALS [PRO, NNC05GA27G:**

PRO 1) Sashidhar S. Panchamgam, ”Study of Microscale Transport Processes and Interfacial Phenomena in Evaporating Thin Films Using Vertical Constrained Vapor Bubble (VVCB)”, Ph. D. Dissertation Proposal, Isermann Department of Chemical and Biological Engineering, Rensselaer Polytechnic Institute, Troy, NY, May, 2005.

T 1) Sashidhar S. Panchamgam, ”Interfacial Phenomena and Microscale Transport Processes in Evaporating Ultrathin Menisci” Ph. D. Thesis, The Isermann Department of Chemical and Biological Engineering, Rensselaer Polytechnic Institute, Troy, NY, September, 2006.

**ANNUAL PROGRESS REPORTS [ANN] NNC05GA27G:**

ANN 1) Peter C. Wayner, Jr and Joel L. Plawsky, “R & D Work on the Constrained Vapor Bubble System for a Microgravity Experiment: First Annual Progress Report for NNC05GA27G for the Period April 5, 2005 –February 4, 2006” submitted February, 2006.

## 2. PUBLICATIONS AND PRESENTATIONS FOR NAG3-2383.

### PRESENTATIONS, NAG3-2383 [PR]:

PR 1. Wang, Y- X, Plawsky, J. L., and Wayner, P. C., Jr., "Optical Measurement of Microscale Transport Processes in Dropwise Condensation", United Engineering Foundation Meeting , Banff, Canada, Oct. 15-20, 2000. Published in Proceedings of the International Conference on Heat Transfer and Transport Phenomena in Microscale, pp 253-260, Editor: Gian Piero Celata, Begell House, Inc., New York, New York, 2000.

PR2. Wang, Y- X, Plawsky, J. L., and Wayner, P. C., Jr., "Optical Measurement of Thermally Driven Interfacial Flows" Paper 133f, Annual Meeting of AIChE, Los Angeles, CA, Nov. 12-17, 2000.

PR3. S. Basu, P. C. Wayner, Jr. , J. L. Plawsky, "Study of Heat Losses For the Dry Cell Calibration of the Constrained Vapor Bubble Heat Pipe", 35 th National Heat Transfer Conference June, 2001, Anaheim, CA. Paper No. NHTC0111681:

PR4. Wayner, P. C., Jr., "Nucleation, Growth, and Surface Movement of a Condensing Sessile Droplet" The International TRI/Princeton Workshop on Nanocapillarity: Wetting of Heterogeneous Surfaces & Porous Solids, Princeton, NJ June 25-27, 2001

PR5. Wang, Y- X, Zheng, L., Plawsky, J. L., and Wayner, P. C., Jr., "Long Range Intermolecular Forces in Change-of-Phase Heat Transfer", Gordon Research Conference on Gravitational Effects in Physico-Chemical Systems: Interfacial Effects, July 8-13, 2001, New London, NH.

PR6. Plawsky, J. L., Wang, Y- X, Zheng, L., and Wayner, P. C., Jr., "Condensate Removal Mechanisms in a Constrained Vapor Bubble Heat Exchanger", Conference & Exhibit on International Space Station Utilization, Kennedy Space Center, Fl, October 15-18, 2001, Paper # AIAA 2001-4957.

PR 7. Ling Zheng, Yingxin Wang, Peter C. Wayner, Jr. Joel L. Plawsky," Condensate Removal Mechanisms in a Constrained Vapor Bubble Heat Exchanger", Paper # MTP-01-29, Proceedings of the United Engineering Foundation Meeting on "Microgravity Transport Processes in Fluid, Thermal, Biological and Material Sciences II", September 30-October 5, 2001, Banff, Alberta, Canada.

PR 8. Wayner, P. C., Jr., "Adsorption, Evaporation, Condensation, and Fluid Flow in the Contact Line Region", Third International Symposium on Contact Angle, Wettability, and Adhesion, Providence, RI, May 20-22, 2002.

PR 9. Gokhale, S. J., Plawsky, J. L. and P. C. Wayner, Jr., "Effect of Interfacial Superheat on Liquid Profile and Spreading in Dropwise Condensation" 12th International Conference on Surface Forces, Moscow, Russia, June 29 – July 5, 2002.

PR 10. Wayner, P. C., Jr., "Effect of Interfacial Phenomena on a Condensing Sessile Droplet", The Third International Conference on Transport Phenomena in a Multiphase System, Kielce, Poland, June 24 – 27, 2002.

- PR 11. Wayner, P. C., Jr., Plawsky, J. L., Zheng, L., and Wang, Y -X, "Constrained Vapor Bubble Experiment" Sixth Microgravity Fluid Physics and Transport Phenomena Conference, Cleveland, OH, Aug. 14-16, 2002.
- PR 12. Gokhale, S. J., Plawsky, J. L. and P. C. Wayner, Jr., "Interfacial Dynamics During Dropwise Condensation and Evaporation," AIChE 2002 Annual Meeting, November 3-8, 2002, Indianapolis, Indiana.
- PR 13. Gokhale, S. J., Plawsky, J. L. and P. C. Wayner, Jr., "Microscale Interfacial Phenomena in Dropwise Condensation and Evaporation Processes," 2003 ASME Summer Heat Transfer Conference, July 20 – 23, 2003, Las Vegas, Nevada.
- PR 14. Basu, S., Plawsky, J. L. and P. C. Wayner, Jr., "Experimental Study of a Constrained Vapor Bubble Fin Heat Exchanger in the Absence of External Natural Convection", Microgravity Transport Processes in Fluid, Thermal, Biological and Materials Sciences Conference III, September 14-19, 2003, Davos, Switzerland.
- PR 15. S. J. Gokhale, S. DasGupta, J. L. Plawsky and P. C. Wayner, Jr., "Experimental Verification of the Pressure Gradient with Phase Change in the Contact Line Region" UK HEAT TRANSFER, 8<sup>th</sup> UK National Heat Transfer Conference, Oxford, England, September 9-10, 2003 Paper # PC 4.
- PR 16. S. J. Gokhale, S. DasGupta, J. L. Plawsky and P. C. Wayner, Jr., "Experimental Evaluation of Interfacial Profile and Pressure Variation in a Spreading Droplet During Condensation", 2003 AIChE Annual Meeting Extended Abstract # 244d, San Francisco, CA.
- PR 17. The following paper was presented at the Conference-Workshop on Strategic Research to Enable NASA's Exploration Mission, June 22-23, 2004, Cleveland, OH. : Constrained Vapor Bubble, Joel L. Plawsky and Peter C. Wayner, Jr.
- PR 18. S. S. Panchamgam, S. J. Gokhale, S. DasGupta, J. L. Plawsky and P. C. Wayner, Jr., "A Study of an Oscillating Corner Meniscus with Phase Change Using Image Analyzing Interferometry", Presented at the 2004 ASME Heat Transfer/Fluids Engineering Summer Conference, Charlotte, NC, July 11-15, 2004 and published in the proceedings: # HT-FED2004-56146.
- PR 19) Shripad J. Gokhale, Joel L. Plawsky and Peter C. Wayner, Jr.  
"Spreading, Evaporation and Contact Line Dynamics of Surfactant Laden Micro-Drops", 2004 AIChE Annual Meeting, November 7-12, Austin, TX, Presentation and Abstract # 185a.

PR 20) Shripad J. Gokhale, Joel L. Plawsky and Peter C. Wayner, Jr., "Optical Investigation of the Interfacial Phenomena during Coalescence of two Condensing Drops and Shape Evolution of the Coalesced Drop" 2004 AIChE Annual Meeting, November 7-12, Austin, TX, Presentation and Abstract # 169f.

PR 21) Sashidhar S. Panchamgam, Shripad J. Gokhale, Joel L. Plawsky, Sunando DasGupta, and Peter C. Wayner, Jr., "Measurement of the Effect of Disjoining Pressure on Shear in an Oscillating Evaporating Contact Line Region," First Joint Meeting of the American Institute of Chemical Engineers and the Indian Institute of Chemical Engineers, Mumbai, India, December 27-30, 2005.

PR 22) Peter C. Wayner, Jr., Invited Institute Lecture: "Reflectivity Based Studies of Interfacial Phenomena in Equilibrium and Non-Equilibrium Systems," IIT Karagpur, December 13, 2004.

#### PUBLICATIONS, **NAG3-2383** [PU]:

PU1. Wang, Y- X, Plawsky, J. L., and Wayner, P. C., Jr., "Optical Measurement of Microscale Transport Processes in Dropwise Condensation", Microscale Thermophysical Engineering, Vol. 5, #1, pp 55-69, 2001.

PU2. Wang, Y- X, Plawsky, J. L., and Wayner, P. C., Jr., "Optical Measurement of Microscale Transport Processes in Dropwise Condensation", United Engineering Foundation Meeting , Banff, Canada, Oct. 15-20, 2000. Published in Proceedings of the International Conference on Heat Transfer and Transport Phenomena in Microscale, pp 253-260, Editor: Gian Piero Celata, Begell House, Inc., New York, New York, 2000.

PU3. S. Basu, P. C. Wayner, Jr. , J. L. Plawsky, "Study of Heat Losses For the Dry Cell Calibration of the Constrained Vapor Bubble Heat Pipe". 2001 National Heat Transfer Conference, June 10 -12, 2001, Anaheim, CA, Paper No. NHTC0111681, ASME, NY, NY.

PU4. P. C. Wayner, Jr., "Interfacial Forces in Enhanced Phase-Change Heat Transfer" Invited contribution in Mc-Graw-Hill Yearbook of Science & Technology 2002, pp 156-159, Mc-Graw-HILL, New York, NY, 2001.

PU5. L. Zheng, Y. X. Wang, J. L. Plawsky, and P. C. Wayner, Jr. "Effect of Curvature, Contact Angle, and Interfacial Subcooling on Contact Line Spreading in a Microdrop in Dropwise Condensation" Langmuir, Vol. 18, pp 5170-5177, 2002.

PU 6. Wayner, P. C., Jr., "Nucleation, Growth, and Surface Movement of a Condensing Sessile Droplet", Colloids and Surfaces A: Physicochemical and Engineering Aspects, Vol. 206 (2002) 157-165.

PU 7. Wang, Y- X, Zheng, L., Plawsky, J. L., and Wayner, P. C., Jr., "Optical Evaluation of the Effect of Curvature and Apparent Contact Angle in Droplet Condensate Removal", J of Heat Transfer, Vol. 124, 2002, 729-738.

PU 8. Wayner, P. C., Jr., "Effect of Interfacial Phenomena on a Condensing Sessile Droplet", in HEAT 2002, Proceedings of The Third International Conference on Transport Phenomena in a Multiphase Systems, Kielce, Poland, June 24 – 27, 2002, , Editor M E. Poniewski, pp 171- 177.

- PU 9. Ling Zheng, Yingxin Wang, Peter C. Wayner, Jr. Joel L. Plawsky,” Condensate Removal Mechanisms in a Constrained Vapor Bubble Heat Exchanger”, in “Microgravity Transport Processes in Fluid, Thermal, Biological and Material Sciences”, Annals of the New York Academy of Sciences, Vol. 974, Editor S. S. Sadhal, 274-287 (2002).
- PU 10. Gokhale, S. J., Plawsky, J. L. and P. C. Wayner, Jr., “Experimental Investigation of Contact Angle, Curvature, and Contact Line Motion in Dropwise Condensation and Evaporation” Journal of Colloid and Interface Science, Vol. 259, pp 354-366 (2003).
- PU 11. Zheng L., Wang, Y- X, Wayner, P. C., Jr., and , Plawsky, J. L., “Microscale Transport Processes in the Evaporator of a Constrained Vapor Bubble” AIAA Journal of Thermophysics and Heat Transfer, Vol.17, No.2, 2003, pp 166 -173.
- PU 12. Gokhale, S. J., Plawsky, J. L. and P. C. Wayner, Jr., “Effect of interfacial phenomena on dewetting in dropwise condensation” Advances in Colloid and Interface Science, 104, 2003, 175 - 190.
- PU 13. Basu, S., Plawsky, J. L. and P. C. Wayner, Jr. , “Experimental Study of a Constrained Vapor Bubble Fin Heat Exchanger in the Absence of External Natural Convection”. Proceedings of the Microgravity Transport Processes in Fluid, Thermal, Biological and Materials Sciences Conference III, September 14-19, 2003, Davos, Switzerland. Paper number ECI: MTP-03-03.
- PU 14. S. J. Gokhale, S. DasGupta, J. L. Plawsky and P. C. Wayner, Jr., “Experimental Verification of the Pressure Gradient with Phase Change in the Contact Line Region” Proceedings of 8<sup>th</sup> UK National Heat Transfer Conference, Oxford, England, September 9-10, 2003, Paper # PC 4.
- PU 15. P. C. Wayner, Jr. , “Adsorption, Evaporation, Condensation, and Fluid Flow in the Contact Line Region”, 2003, pp 3-32, in Contact Angle, Wettability, and Adhesion, Vol. 3, Editor K. L. Mittal, VSP BV, The Netherlands.
- PU 16. S. J. Gokhale, S. DasGupta, J. L. Plawsky and P. C. Wayner, Jr., Experimental Evaluation of Interfacial Profile and Pressure Variation in a Spreading Drop During Condensation”, 2003 AIChE Annual Meeting Extended Abstract # 244d, San Francisco, CA.
- PU 17. S. J. Gokhale, J. L. Plawsky, and P. C. Wayner, Jr., S. DasGupta. (New title) “Inferred Pressure Gradient in a condensing sessile droplet based on the measured thickness profile”, Physics of Fluids, 16, 2004, 1942-1955.
- PU 18. S. S. Panchamgam, S. J. Gokhale, S. DasGupta, J. L. Plawsky and P. C. Wayner, Jr., “A Study of an Oscillating Corner Meniscus with Phase Change Using Image Analyzing Interferometry”, # HT-FED2004-56146, Proceedings of the 2004 ASME Heat Transfer/Fluids Engineering Summer Conference, Charlotte, NC, July 11-15, 2004.
- PU19. L. Zheng, J.L. Plawsky, P. C. Wayner, Jr., S. DasGupta, “stability and Oscillations in an Evaporating Meniscus,” Journal of Heat Transfer, 126, 2004, 169-178.
- PU 20. P. C. Wayner, Jr., J.L. Plawsky “R & D Work on the Constrained Vapor Bubble System for a Microgravity Experiment”, Task Book 2004 and 2004 Annual Report (Prelude) for NAG3-2383 were submitted to Office of Biological and Physical Research, OBPR. ((October 2004).

PU 21) [SU 9] S. J. Gokhale, S. DasGupta, J. L. Plawsky, and P. C. Wayner, Jr. , “Reflectivity Based Evaluation of the Coalescence of Two Condensing Drops and Shape Evolution of the Coalesced Drop” Physical Review E, 70, 051610, November 30, 2004[ old title: “Experimental Analysis of the Coalescence of Two Condensing Drops and Shape Evolution of the Coalesced Drop”] submitted to Physical Review Letters. At the advice of Physical Review Letters, the paper was rewritten, expanded, and submitted to Physical Rev E..

PU 22) Sashidhar S. Panchamgam, Shripad J. Gokhale, Joel L. Plawsky, Sunando DasGupta, and Peter C. Wayner, Jr., “Measurement of the Effect of Disjoining Pressure on Shear in an Oscillating Evaporating Contact Line Region,” Extended Abstract, First Joint Meeting of the American Institute of Chemical Engineers and the Indian Institute of Chemical Engineers, Mumbai, India, December 27-30, 2005.

#### THESES [T], RELATED STUDENT PROPOSALS [PRO], **NAG3-2383:**

PRO1)S. Basu, “Experimental and Thermal Modeling of the Constrained Vapor Bubble Wickless Heat Pipe”, Ph. D. Dissertation Proposal, Department of Chemical Engineering, Rensselaer Polytechnic Institute, Troy, NY, March, 2001.

PRO2) Shripad Gokhale, “Study of Microscale Interfacial Phenomena in Phase Change Processes”, Ph. D. Dissertation Proposal, Department of Chemical Engineering, Rensselaer Polytechnic Institute, Troy, NY, October, 2003.

T1) Wang, Y- X, “A Study of the Vertical Constrained Vapor Bubble” Ph. D. Thesis, Rensselaer Polytechnic Institute, Troy, NY, May, 2001.

T2) Sumita Basu Ph.D. Thesis “Experimental Study and Thermal Modeling of the Constrained Vapor Bubble Heat Pipe Operation in a Convection-Free Environment under the Influence of Gravity” Chemical Engineering Department, Rensselaer Polytechnic Institute, Troy, NY, January, 2002.

T3) Shripad J. Gokhale , “Study of Microscale Interfacial Phenomena During Phase Change Processes : Analysis of Micro-Drop and Thin Films,” Ph. D. Thesis, Department of Chemical and Biological Engineering, Rensselaer Polytechnic Institute, Troy, NY, January, 2005.